

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

IRRIGATION LAND LEVELING

(acre)
Code 464



DEFINITION

Reshaping the surface of land to be irrigated to planned grades.

PURPOSE

This practice may be applied as part of a resource management system to permit uniform and efficient application of irrigation water to the leveled land.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to leveling irrigated land on the basis of detailed engineering survey, design, and layout. It does not include NRCS conservation practice standards Precision Land Forming, Code 462 or Land Smoothing, Code 466. Procedures for design and layout of irrigation land leveling are contained in National engineering Handbook (NEH), Part 623, Irrigation, Chapter 12.

CRITERIA

Criteria applicable to all irrigation methods.

Planned work shall comply with all Federal, State, and local laws and regulations.

Land to be leveled shall be suitable for irrigation and for the proposed methods of water application. Water supplies and irrigation deliveries to the area to be leveled shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application method to be used.

Soils shall be deep enough so that after leveling an adequate, usable root zone remains that will permit satisfactory crop production with proper conservation measures. Limited areas of shallower soils may be leveled to provide adequate irrigation grades or a better field arrangement. The finished leveling work must not result in exposed areas of highly permeable materials that can inhibit proper distribution of water over the field.

All leveling work shall be planned as an integral part of an overall farm irrigation system to enhance the conservation of soil and water resources. The boundaries, elevations, and direction of irrigation of individual field leveling jobs shall be such that the requirements of all adjacent areas in the farm unit can be met.

Field grades. If more than one method of water application or more than one kind of crop is planned, the land must be leveled to meet the requirements of the most restrictive method and crop. All leveling work must be designed within the slope limits required for the methods of water application to be used, to provide for the removal of excess surface water, and to control erosion caused by rainfall. Reverse grades in the direction of irrigation shall not be permitted.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Surface drainage. Farm irrigation systems shall include plans for removing or otherwise controlling excess irrigation and storm water. Leveling designs must provide field elevations and field grades that will permit proper functioning of the planned drainage system facilities.

Maximum field elevation. All leveling work shall be designed to permit delivery of needed irrigating streams onto the highest point on the field surface. The field elevation shall be at least 0.33 foot below the water surface elevation at the point of delivery.

Additional criteria applicable to level irrigation methods.

Slope. The maximum fall in the direction of irrigation shall not exceed one-half the design depth of application for a normal irrigation. The difference in elevation across an individual border strip shall not exceed 0.10 foot.

Slope. The maximum slope in the direction of irrigation if rainfall erosion is not a significant problem shall be as follows:

1. Furrows - 3 percent,
2. Corrugations - 8 percent,
3. Borders for nonsod-forming crops, such as alfalfa or grain - 2 percent,
4. Borders for erosion-resistant grass or grass-legume crops or for nonsod-forming crops on sites where water application by the border method will not be required until after good crop stands have been established - 4 percent.

In areas where potential for rainfall erosion is great, the maximum slope for furrows shall be 0.5 percent and 2 percent for borders for sod forming grasses and 0.5 percent for other crops.

On slopes in the direction of irrigation of more than 0.5 percent where leveling designs provide for increasing or decreasing slopes, the following limits shall apply:

1. The maximum slope in an irrigation run shall be no more than twice the minimum
2. The change in slope in any 100-foot reach shall not exceed one-half the maximum permissible change along the length of run, except, short, level sections are permissible

at the upper or lower ends of irrigation runs to facilitate water control or to reduce runoff.

3. The maximum permissible slope change is the difference between the flattest and steepest design slope along the length of run.

The maximum cross slope for borders shall be 0.10 foot per foot border strip width.

The allowable cross slope for furrows and corrugations depends on the stability of the soil, the size of furrows that are to be used, and the rainfall pattern in the area. Cross slopes must be such that "breakthroughs" from both irrigation water and runoff from rainfall are held to a minimum.

Additional criteria applicable to level subsurface methods.

Slope. In areas where irrigation is practiced through ground water level control, the field surface shall be shaped to parallel the expected subsurface water elevations. The design shall consider the desired depth from the soil surface to the elevation of the ground water.

Additional criteria applicable to subirrigation methods.

Slope. In areas where subirrigation is practiced through ground water level control the field surface shall be shaped to parallel the expected subirrigation water elevations. The design shall consider the desired depth from the soil surface to the elevation of the ground water.

The permissible slope ranges in the direction of irrigation shall be 0.00 foot per foot to 0.0050 foot per foot. The cross slope shall range from 0.00 foot per foot to 0.0050 foot per foot except that cross slopes of up to 0.010 foot per foot may be allowed where the size of furrows is such that break throughs from rainfall runoff are held to a minimum.

CONSIDERATIONS

In the design consider the excavation and fill material required for or obtained from such structures as ditches, ditch pads, and roadways. The appropriate yardage shall be included when balancing cuts and fills and determining borrow requirements.

Consider related structures and measures needed to control irrigation water and/or storm water runoff.

Consider crops, method of irrigation, soil intake rates, field slope, irrigation stream size and resulting deep percolation and runoff when determining or evaluating length of irrigation runs.

Consider the depth of cuts and the resulting available plant rooting depths to saline soils and to shallow water tables.

In areas with sediment laden irrigation water consider increasing the required height of the water surface at the point of delivery.

Consider effects on irrigation efficiencies, especially on volumes and rates of runoff, infiltration, evapotranspiration and deep percolation.

Consider effects on water flows and aquifers and the affect to other water uses and users.

Consider the effects on adjacent wetlands.

PLANS AND SPECIFICATIONS

Plans and specifications for irrigation land leveling shall be site specific and shall show the requirements for installing the practice to achieve its intended purpose. Site specifics typically include field boundaries, planned cuts and fills, earthwork volumes, cut/fill ratio, direction of irrigation, design down slope and cross slope, required water surface and location of irrigation water delivery, tailwater disposal, and appurtenant structures.

OPERATION AND MAINTENANCE

The maintenance on leveled fields includes the periodic removal or grading of mounds and/or depressions. Land grading may periodically be needed to restore the design gradient.

REFERENCES

NEH Part 623, Irrigation, Chapter 12.